4

Trade Model Extensions and Applications

The analysis so far has stressed the importance of relative price differentials among trading partners as an immediate basis for trade. Relative prices of goods entering international trade reflect the supply and demand conditions existing in the trading nations. An account should thus be made of supply and demand factors such as resource endowments, technology, tastes and preferences, and income levels among nations. This chapter considers some leading theories that attempt to explain what creates the immediate basis for trade. Attention will then turn to the role of transportation costs and their impact on trade flows.

THE HECKSCHER-OHLIN THEORY OF FACTOR ENDOWMENTS

Ricardian trade theory argues that the basis for trade stems from differences in international production characteristics and factor productivities due to domestic differences in natural advantages and acquired advantages. But other than offering this general explanation, Ricardian theory does little to explain what causes discrepancies in comparative costs and differences in domestic transformation curves.

It was not until two Swedish economists, Eli Heckscher and Bertil Ohlin, formulated the *factor endowment theory* that an explanation was provided for the differences in comparative costs among trading partners.[1] According to Heckscher-Ohlin, international differences in *supply* conditions explain much of international trade. Supply conditions include factor productivities as well as factor endowments. Unlike Ricardian trade theory, which places primary reliance on factor productivities as the main determinant of the basis for trade, the Heckscher-Ohlin model delegates primary importance to the factor endowments nations enjoy.

Factor Endowment Model

The factor endowment model asserts that the pattern of trade is explained primarily by differences in relative national supply conditions. Heckscher-Ohlin attribute relative price differentials to differences in national *resource endowments.* This is because the other determinants affecting relative prices are not considered to be important. Heckscher-Ohlin assumed that trading partners have the same tastes and preferences (demand conditions), use factors of production that are of uniform quality, and use the same technology. The productivity or efficiency of a given resource unit is thus identical for both trading nations.

The factor endowment model argues that relative price levels differ among nations because: (1) they have different relative endowments of factors of production; (2) different commodities require that the factor inputs be used with differing intensities in their production. Given these circumstances, a nation will export that commodity for which a large amount of the relatively *abundant* (cheap) input is used. It will import that commodity in the production of which the relatively *scarce* (expensive) input is used. The principal explanation of the pattern of trade lies in the uneven distribution of world resources among nations, coupled with the fact that commodities require different proportions of the factors of production. When a nation possesses an abundance of the factors of production required in great amounts to produce a commodity, its price for that commodity will be low relative to its price for another commodity requiring great amounts of scarce resources.

Figure 4.1 illustrates the trading position of France and Germany. Assume that auto production is capital intensive, requiring much capital and little land. Similarly, wheat production is assumed to be land intensive, requiring much land and little capital. Suppose that capital is relatively abundant in Germany. Indicating the suitability of its resources for producing capital-intensive autos, Germany's transformation curve is biased toward the auto

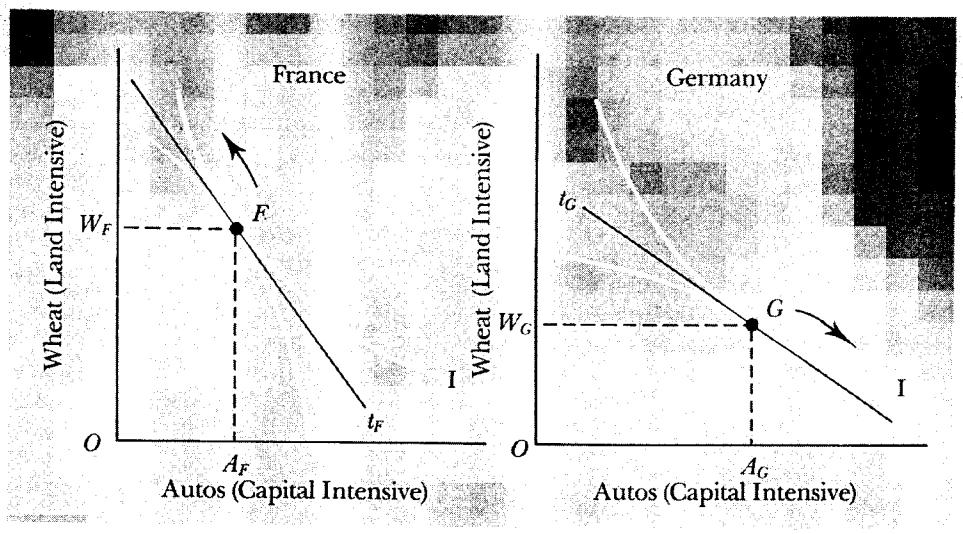

Figure 4.1. Comparative Advantage According to the Factor Endowment Theory

axis. The abundance of land in France causes its transformation curve to be biased toward the wheat axis.

According to the factor endowment model, demand conditions are assumed to be identical for each nation. This is illustrated in figure 4.1 by the community indifference curves of France and Germany, which are the same in shape and location. The points where the two countries' indifference curves are tangent to their respective transformation curves indicates the autarky equilibrium locations for each country. In autarky, Germany locates at point *G* on its transformation curve while France locates on its transformation curve at point *F*. The relative price ratios at these points suggest that Germany has the comparative advantage in auto production while France has the comparative advantage of producing wheat.

The above example depicts the Heckscher-Ohlin reasoning that given identical demand conditions and input productivities, the differences in the relative abundance of factors of production determine relative price levels and the pattern of trade. Capital becomes relatively cheaper in the capital-abundant country and land relatively cheaper in the land-abundant country.

The capital-abundant country will thus export the capital-intensive product, and the land-abundant country will export the land-intensive product. The factor endowment model concludes that each country exports the commodities that are relatively intensive in the factor with which it is relatively well endowed.

Factor Price Equalization

Free trade tends to result in an equalization of commodity prices among trading partners. Can the same be said for factor input prices?[2] A nation with trade finds output expanding in its comparative advantage industry, which utilizes a lot of the cheap, abundant factor. The price of the abundant factor increases as the result of the rise in its demand. The expensive, scarce factor is simultaneously being released from the comparative disadvantage industry. In order to induce producers to employ this factor, its price must decrease. Because this situation occurs at the same time in both trading partners, there will occur in each nation a rise in the price of its abundant factor and a fall in the price of the scarce factor. Trade therefore leads toward an equalization of the relative factor prices in the two trading partners.

In the above example, the French demand for inexpensive German autos results in an increased German demand for its abundant factor, capital. The price of capital rises in Germany. As France produces fewer autos, its demand for capital decreases, the result being a fall in the price of capital. The effect of trade is to equalize the price of capital in the two nations. Similarly, the German demand for cheap French wheat leads to France demanding more land, its abundant factor. The French price of land rises. With Germany producing less wheat, its demand for land decreases, and the price of land falls. The price of land with trade tends to equalize in the two trading partners.

By redirecting global demand away from the scarce factor toward the abundant factor in each nation, trade leads toward factor price equalization. In each country the cheap factor becomes more expensive while the expensive factor becomes cheaper. The factor endowment theory suggests that trade leads toward an equalization of factor prices. But in the real world, actual differences in factor prices do exist. For example, the average salary of unskilled labor in the United States is higher than in Korea. That resource prices may not fully equalize between trading partners can in part be explained by the fact that the assumptions underlying the factor endowment theory are not completely met in the real world. For example, to the extent that different countries use different technologies or that markets are not perfectly competitive in trading nations, factor prices may only partially equalize. The existence of transportation costs and barriers to trade may prevent product prices from becoming equal. Such market imperfections

reduce the volume of trade, hence limiting the extent to which commodity prices as well as factor prices can equalize.

The Distribution of Income and Trade

It has been shown how free trade can increase the level of world output. Each trading nation can obtain higher combinations of commodities that lie beyond its domestic capacity to produce. A nation's income thus rises with trade. But the prices of the factors of production determine factor incomes. Trade therefore affects not only the national income level, but also the internal distribution of income among the factors of production.

The factor endowment theory reasons that the export of commodities embodying large amounts of the relatively cheap, abundant factors makes those factors less abundant in the domestic market. The import of the commodities intensely using the expensive, scarce factor makes those factors less scarce. Exports thus tend to increase the return going to the cheap, abundant factor, while imports will lower the return going to the expensive, scarce factor. The relative share of a country's national income going to the abundant factor rises, while that going to the scarce factor falls. The factor endowment theory concludes that with free trade, the abundant factor enjoys a greater portion of the gains from trade than the scarce factor.

Does the above set of circumstances mean that the scarce factor is worse off with free trade than it is in the absence of trade? Does the adverse redistribution of income that occurs mean its absolute level of income with trade is actually lower than without trade? Not necessarily! Even though the scarce factor suffers an adverse relative redistribution of income, the country's income will be rising with trade. By accepting free trade, the scarce factor may be able to benefit with a smaller share of a rising income that is superior to the greater share of the smaller income it would have in the absence of trade.

THE LEONTIEF PARADOX

The first major attempt to investigate the factor endowment theory empirically was undertaken by Wassily Leontief in 1953.[3] Leontief noted that it was widely recognized that in the United States capital was relatively abundant and labor was relatively scarce. Applying the factor endowment theory to the United States, isn't it reasonable that the United States would be exporting capital-intensive goods while its import-competing goods would be labor intensive?

Leontief tested this proposition by analyzing the capital/labor ratios for some 200 export industries and import-competing industries in the United States. As indicated in table 4.1, Leontief found that the capital/labor ratio for

Table 4.1. Domestic Capital and Labor Requirements per Million Dollars of U.S. Exports and of Competitive Import Replacements (of average 1947 composition)

	Exports	Import Replacements
Capital (in 1947 dollars)	$2,550,780	$3,091,339
Labor (man-years)	182	170
Capital/labor ratio (capital per man-year)	14,015	18,184

Source: Wassily Leontief, "Domestic Production and Foreign Trade: The American Capital Position Reexamined," *Proceedings of the American Philosophical Society,* 97 (September 1953); reprinted in Richard E. Caves and Harry C. Johnson, eds., *Readings in International Economics* (Homewood, Ill.: Richard D. Irwin, 1968), pp. 503–527.

U.S. export industries was *lower* than that of its import-competing industries, suggesting that exports were *less* capital intensive than import-competing goods! But the United States is supposed to be endowed with relatively large amounts of capital compared to the rest of the world. In a later study, Leontief again found that U.S. import goods were more capital intensive relative to U.S. exports. Leontief concluded that contrary to what the factor endowment theory suggests, the production of U.S. exports is labor intensive as compared to import-competing goods which are capital intensive. Leontief's paradoxical results motivated similar studies for other countries. Although the Leontief analysis has been questioned on both statistical and methodological grounds, many other studies have challenged the general applicability of the factor endowment theorem.

COMPARATIVE LABOR COSTS

Shortcomings of the factor endowment theory prompted efforts to explain international trade patterns in terms of comparative labor costs. At least two factors determine a country's competitive position—labor productivity and wage levels. Together they constitute the unit labor costs involved in producing a commodity. One country may find its labor productivity to be much higher than that of its trading partner, while its average wage rates are also higher. Should the overall difference in productivity more than offset the overall difference in wage rates, the first country may still find itself in a favorable position!

One of the earliest investigations of the theory of comparative costs was made by the British economist G. D. A. MacDougall in 1950.[4] MacDougall compared the export pattern of 25 separate industries for the United States and the United Kingdom. As shown in table 4.2, in each industry studied the U.S. labor productivity exceeded that of the United Kingdom. MacDougall

Table 4.2. United States and United Kingdom Prewar Output per Worker and Quantity of Exports in 1937

United States output per worker more than twice the United Kingdom	
Wireless sets and valves	U.S. exports 8 times U.K. exports
Pig Iron	U.S. exports 5 times U.K. exports
Motor cars	U.S. exports 4 times U.K. exports
Glass containers	U.S. exports 3½ times U.K. exports
Tin cans	U.S. exports 3 times U.K. exports
Machinery	U.S. exports 1½ times U.K. exports
Paper	U.S. exports 1 times U.K. exports
United States output per worker 1.4 to 2.0 times the United Kingdom	
Cigarettes	U.K. exports 2 times U.S. exports
Linoleum, oilcloth, etc.	U.K. exports 3 times U.S. exports
Hosiery	U.K. exports 3 times U.S. exports
Leather footwear	U.K. exports 3 times U.S. exports
Coke	U.K. exports 5 times U.S. exports
Rayon weaving	U.K. exports 5 times U.S. exports
Cotton goods	U.K. exports 9 times U.S. exports
Rayon making	U.K. exports 11 times U.S. exports
Beer	U.K. exports 18 times U.S. exports
United States output per worker less than 1.4 times the United Kingdom	
Cement	U.K. exports 11 times U.S. exports
Men's/boys' outer wool clothing	U.K. exports 23 times U.S. exports
Margarine	U.K. exports 32 times U.S. exports
Woolen and worsted	U.K. exports 250 times U.S. exports
Exceptions (U.S. output per worker more than twice the United Kingdom, but U.K. exports exceed U.S. exports): electric lamps, rubber tires, soap, biscuits, watches.	

Source: G. D. A. MacDougall, "British and American Exports: A Study Suggested by the Theory of Comparative Costs," *Economic Journal,* 61 (1951).

also found that on average, American wage rates were twice as high as British wage rates. According to MacDougall, it would follow that the U.S. share of world export markets would exceed the United Kingdom share in those industries where American labor was *more than twice* as productive as British workers. In those industries where British workers were *more than half* as productive as their American competitors, Britain would have the cost advantage and would find its share of export markets rising above that of the United States.

Referring to table 4.2, MacDougall found that of the 25 industries studied, 20 fit the predicted pattern. The United States had the largest share of the exports when its labor productivity was at least twice the British productivity. MacDougall's findings appear to have merit in relating export patterns to wage levels and labor productivity. But his test of the theory of comparative costs is not without limitations. Labor is not the only factor input.

Allowance should be made where appropriate for production and distribution costs other than direct labor. Differences in product quality also explain trade patterns in industries such as automobiles and footwear. One should therefore proceed with caution in explaining a country's competitive position on the basis of labor productivity and wage levels.

International Labor Comparisons

This section reviews some recent international labor trends. Table 4.3 displays international comparisons of hourly compensation in manufacturing. In the early 1960's, American labor in manufacturing was compensated at levels significantly above those of most other countries. By the mid-1970's, other industrialized countries had eliminated much of the compensation differentials as foreign workers enjoyed larger percentage increases in compensation than did American workers. Although labor compensation has been on the upswing in many less-developed countries, on average it still remains quite low.

Another variable behind a country's competitive position is productivity growth. As seen in table 4.4, throughout the 1970's the annual productivity gain of the United States has been below that of many other industrial countries. Incorporating the concepts of labor productivity and compensation levels, table 4.5 summarizes recent trends in unit labor costs in manufacturing or the costs of labor per unit of manufacturing output. It should be emphasized that unit labor costs are not an all-embracing guide to a country's competitive position. They are an important determinant of the prices of manufactured goods, but other costs also influence price—notably those of capital, energy, and raw materials. Moreover, a country's competitive position is not solely determined by price. Salesmanship, credit terms, adherence to delivery schedules, and so on also have a bearing on competitiveness.

Table 4.3. Trends in Hourly Compensation in Manufacturing in U.S. Dollars (annual rate of change)

Year	United States	France	West Germany	Italy	Nether-lands	United Kingdom	Japan	Canada
1971	6.7%	12.0%	18.8%	17.0%	18.5%	15.9%	18.9%	11.2%
1972	5.5	21.8	21.9	21.4	24.6	14.9	31.4	10.0
1973	6.7	30.1	36.8	27.0	37.7	9.9	36.5	8.8
1974	10.1	10.3	18.4	11.4	25.3	21.9	21.9	18.2
1975	11.7	32.7	18.6	28.5	22.3	21.2	15.3	10.1
1976	8.3	2.6	3.4	−5.9	7.3	−4.0	8.0	17.6
1977	8.8	11.5	18.4	10.9	17.4	6.3	20.8	2.7

Source: International Economic Indicators (Washington, D.C.: U.S. Department of Commerce, December 1978), p. 87.

Table 4.4. Trends in Productivity in Manufacturing: Output per Labor-Hour (annual rate of change)

Year	United States	France	West Germany	Italy	Nether-lands	United Kingdom	Japan	Canada
1971	5.6%	5.3%	4.6%	2.9%	6.7%	4.0%	3.1%	7.2%
1972	5.1	5.9	6.0	8.1	8.0	7.3	7.5	4.6
1973	2.3	5.5	6.1	12.1	10.2	4.1	11.6	4.5
1974	−5.2	2.8	6.1	5.3	8.3	1.1	0.3	1.7
1975	4.9	2.6	3.7	−4.3	−2.1	−2.7	3.9	−2.4
1976	4.3	9.1	8.2	8.3	10.5	3.4	8.1	4.6
1977	2.4	5.2	4.2	0.9	3.6	−1.6	5.6	4.8

Source: International Economic Indicators (Washington, D.C.: U.S. Department of Commerce, December 1978), p. 86.

THEORY OF OVERLAPPING DEMANDS

According to the Heckscher-Ohlin model, international trade is founded upon dissimilar economic structures among trading partners. Applying the factor endowment model to the real world, one would expect that the largest amount of international trade would be between the capital-abundant, industrialized countries and the labor and land-abundant developing countries. It might also be expected that the world trade pattern would involve primarily the exchange of manufactured products for primary commodities. However, post–World War II empirical evidence largely contradicts these extensions of the factor endowment theory. It has been found that international trade primarily has involved manufactured goods for manufactured goods, largely among the industrialized nations. Rather than becoming less similar in economic structure, the industrialized nations have become more similar.

Table 4.5. Trends in Unit Labor Cost in Manufacturing in U.S. Dollars (annual rate of change)

Year	United States	France	West Germany	Italy	Nether-lands	United Kingdom	Japan	Canada
1971	.9%	6.4%	13.6%	13.8%	10.9%	11.4%	15.5%	3.9%
1972	.4	15.1	15.1	12.2	15.4	7.2	22.2	5.1
1973	4.3	23.4	28.9	13.3	25.0	5.0	22.2	4.1
1974	16.1	7.3	11.6	5.8	14.0	20.6	21.6	16.3
1975	6.6	29.3	14.3	34.2	24.8	24.5	19.8	12.8
1976	3.8	−6.0	−4.4	−3.0	−7.2	0.2	12.5	—
1977	6.3	6.0	13.7	9.9	13.3	8.1	14.4	−2.0

Source: International Economic Indicators (Washington, D.C.: U.S. Department of Commerce, December 1978), p. 86.

This negative empirical evidence has led to considerable doubt as to how much of international trade can be explained by the factor endowment theory. Dissatisfaction with the factor endowment model has become particularly acute regarding its ability to explain the trade in *manufactured* goods. During the 1960's a substantial contribution to international trade theory was made by Staffan Linder, a Swedish economist who emphasized the importance that demand plays in explaining the pattern of trade in manufactured goods.[5] Staffan Linder visualizes two explanations of international trade. Linder contends that for trade in *primary* commodities the factor endowment theory provides considerable explanatory value. But for trade in *manufactured* goods, national factor endowment levels hold little explanatory value. This is because the primary force influencing trade in manufactured goods is domestic demand conditions. It follows that because most international trade involves manufactured products, the influence of demand plays the key role in explaining the movement of goods among nations.

Overlapping Demands

According to Linder, the composition of a country's exports in manufactured goods mainly depends on domestic demand conditions. Before products can be sold in competitive international markets they must first be produced and marketed domestically. A business firm will generally desire to sell its product in familiar domestic markets before undertaking operations in less certain foreign markets. For a business firm to initiate production, there must be favorable domestic demand conditions. Internal demand not only gives rise to the initial production of a manufactured good, but it allows the industry to grow large enough to become competitive in foreign markets.

Because an industry initially bases its production decisions on internal demand conditions, it follows that international trade will be most pronounced among countries with similar demand structures for manufactured goods. An industry generally finds that the most favorable foreign market conditions occur when demand patterns abroad are very similar to domestic ones. Linder therefore attributes trade in manufactured goods mainly to the existence of overlapping demands among trading partners.

If two trading partners experience the same demand conditions, they will purchase products characterized by similar degrees of sophistication of quality. But what underlies Linder's concept of demand? Linder contends that tastes and preferences must be supported by purchasing power to become effective. The demand for manufactured goods becomes an *effective demand* when it is backed up by income. It follows that if overlapping demand patterns explain international trade in manufactured goods, countries with similar income levels will tend to be trading partners. The greater the degree of overlap in national demand structures (income levels), the larger will be the potential trade in manufactured goods.

Overlapping Demand Pattern Model

Figure 4.2 illustrates Linder's concept of overlapping demand structures for manufactured goods.[6] The horizontal axis represents a nation's per capita income, considered to be the best measure of effective demand. The vertical axis depicts the degree of product quality or sophistication of each manufactured good demanded. The theory of overlapping demand asserts that there is a strong relationship between the level of per capita income and the degree of quality of the national demand structure as a whole. A rise in per capita income brings about an increase in the level of product sophistication demanded by the public. This relationship is denoted by the line *OA*.

Most societies generally are characterized by uneven distributions of income. To the extent that various members of a given society earn different income levels, there will be a range in the quality of manufactured goods

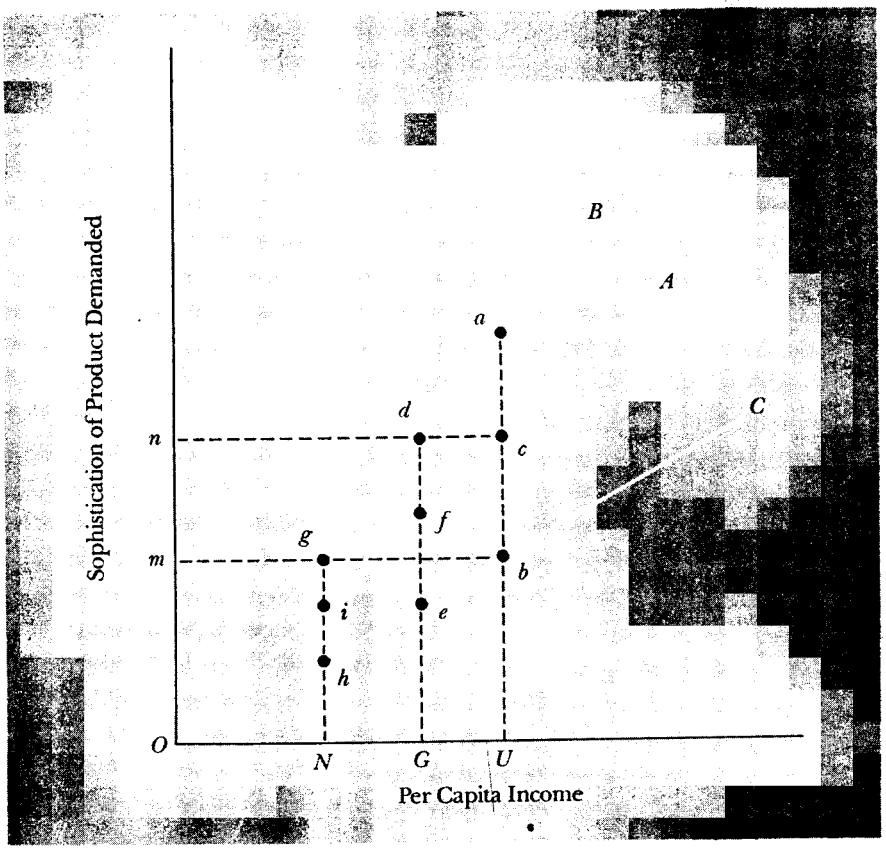

Figure 4.2. Overlapping Demands as a Determinant of Manufactured-Good Trade

demanded. Lower income earners tend to demand products of lower quality than do higher income earners. For example, figure 4.2 suggests that although the U.S. average income level is at point *OU*, the various manufactured goods demanded by different groups in the United States are in quality range *ab*, with *c* as the average. Lines *OB* and *OC* depict a band whose inner area represents the range of product qualities demanded by countries with different per capita incomes. As per capita income rises, the width of the band increases, suggesting that the range of product qualities demanded by a country grows larger as it becomes more affluent.

Consider two industrialized countries, the United States and Canada, whose per capita income levels are respectively denoted by *OU* and *OG*. The demand structures of the two countries suggest that the United States demands products in the quality range *ab*, with *c* as the average. For Canada, the qualitative range is *de*, with *f* as the average. The qualitative range common to both countries is given by *mn*. Trade in manufactured goods will thus be within this range of product quality. Because the U.S. and Canadian income levels are very similar, the countries have substantial overlap in their demand patterns and a relatively large potential for trade between the two countries exists.

One would also expect that trade in manufactured goods between an industrialized country like the United States and a relatively poor nation like Nigeria would be relatively low. Inspection of figure 4.2 reveals that the low level of Nigerian per capita income, *ON*, provides little demand overlap with that of the United States. The high-income earners of the poor country are barely able to afford the same manufactured goods purchased by the lower income earners of the wealthy country. There would only exist a minimal amount of trade in manufactured goods between the two countries. But with the rise of the OPEC cartel during the 1970's, of which Nigeria is a member, the pattern of trade in manufactured goods has changed. Trade in manufactured goods between the industrialized nations and the OPEC nations increased rapidly due to rising average income levels in the cartel nations.[7]

Although Linder's theory of overlapping demands has not been fully tested empirically, it does present an opposing view to the factor endowment theory regarding the basis for trade. Rather than emphasizing supply determinants, Linder assigns primary explanatory value to the role of demand. Unlike the factor endowment theory, which suggests that trade is most pronounced when national economic structures differ, Linder concludes that it is the similarity between national economic structures that gives rise to international trade.

PRODUCT CYCLES

The underlying explanations of international trade presented so far are similar in that they presuppose a given and unchanging state of technology.

The basis for trade was ultimately attributed to such factors as differing labor productivities, factor endowments, and national demand structures. In a dynamic world, technological changes occur in different nations at different rates of speed. Technological innovations commonly result in new methods of producing existing commodities, in the production of new commodities, or in commodity improvements. The direction of comparative advantage and the pattern of trade are thus often affected.

Recognition of the importance of dynamic changes has given rise to another explanation of international trade in manufactured goods, the *product life cycle* theory. The product life cycle theory is primarily concerned with the role of technological innovation as a key determinant of trade patterns in *manufactured* products. Utilizing a dynamic framework, this theory attempts to show how many manufactured products follow a predictable cycle over time.[8]

The Product Life Cycle Model

According to the product life cycle concept, many manufactured goods such as electronic products and office machinery undergo a trade cycle. During this cycle the home country is initially an exporter, then loses its competitive advantage vis-a-vis its trading partners, and may eventually become an importer of the commodity. Figure 4.3 illustrates the stages that many manufactured products go through. These stages include the following:

1. Introduction of manufactured good to home market
2. Domestic industry export strength

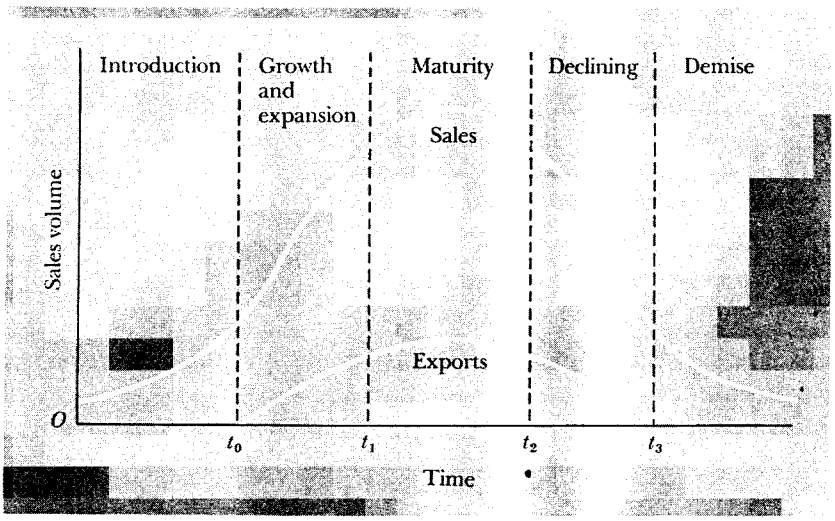

Figure 4.3. Product Life Cycle

3. Foreign production begins
4. Domestic industry loses competitive advantage
5. Import competition begins

The introduction stage of the trade cycle begins when an innovator establishes a technological breakthrough in the production of a manufactured good. The home country initially has an international technological gap in its favor. At the start, the relatively small local market for the product and technological uncertainties imply that mass production is not feasible. The manufacturer will likely operate close to the local market to gain quick feedback concerning the quality and overall appeal of the product. During the trade cycle's next stage, the domestic manufacturer begins to export its product to foreign markets. Once a new product has been successfully introduced and sold at home, it likely will be exported to foreign nations having similar tastes and income levels. The local manufacturer finds that during this stage of growth and expansion its market becomes large enough to support mass production operations and the sorting out of inefficient production techniques. The home country manufacturer is therefore able to supply increasing amounts of the world markets.

As time passes, the domestic manufacturer realizes that in order to protect its export profits it must locate production operations closer to the foreign markets. The domestic industry enters its mature stage as innovating firms establish branches abroad. A major reason for this is that the cost advantage initially enjoyed by an innovator is not likely to last indefinitely. Over time, the innovating country may find that its technology has become more commonplace, and that transportation costs and tariffs play an increasingly important role in influencing selling costs. The innovator may also find that the foreign market is large enough to permit mass production operations. The innovating country therefore tends to locate its production facilities abroad in order to maintain its foreign sales.

Although an innovating country's monopoly position may be prolonged by legal patents, it tends to break down over time. This is because knowledge tends to be a free good in the long run. The benefits an innovating country achieves from its technological gap are short-lived, to the extent that import competition from foreign producers begins. Once the innovative technology becomes fairly commonplace, foreign producers begin to imitate the production process. The innovating country gradually loses its comparative advantage and its export cycle begins to experience a declining phase.

The trade cycle is complete when the production process becomes so standardized that it can be easily utilized by all nations. The technological breakthrough therefore no longer benefits only the innovating country. In fact, the innovating country may finally itself become a net importer of the product as its monopoly position is eliminated by foreign competition. Textiles and paper products are generally considered to have run the full course

of the trade cycle, while electronic computers are still in the early stage of export strength. The spread of automobile production into many parts of the world implies that its production process is close to becoming standardized.

TRANSPORTATION COSTS

Because the movement of goods among nations involves the role of economic distance, the effects of transportation costs cannot be ignored. Transportation costs refer to the costs involved in the movement of goods. Included are freight charges, packing and handling expenses, and insurance premiums. The introduction of transportation costs into the analysis modifies the trade model in two ways. First, the trade effects of transportation costs result in a lower volume of trade, higher import prices, and thus lower gains from trade. Second, transportation costs affect the location of industry and the geographic pattern of trade.

Trade Effects

The trade effects of transportation costs can be illustrated with a conventional supply and demand model based on increasing cost conditions. Figure 4.4 illustrates the demand and supply curves of autos for the United States and Canada. Reflecting the assumption that the United States has the comparative advantage in auto production, the U.S. and Canadian equilibrium autarky locations are respectively at points E and F. In the absence of trade, the U.S. auto price, P_0, is lower than that of Canada, P_1.

When trade is allowed, the United States will move toward greater

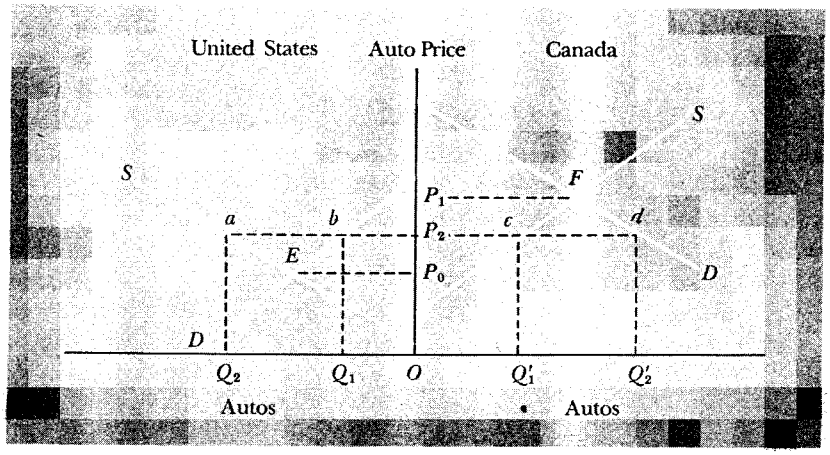

Figure 4.4. Free Trade under Increasing Cost Conditions

specialization in auto production while Canada will produce fewer autos. Under increasing cost conditions, the U.S. cost and price levels rise while that of Canada falls. The basis for trade is eliminated when the two countries' prices equalize at P_2. At P_2 the United States produces Q_2 autos, consumes Q_1 autos, and exports $Q_2 - Q_1$ autos. At P_2 Canada produces Q'_1 autos, consumes Q'_2 autos, and imports $Q'_2 - Q'_1$ autos. P_2 becomes the equilibrium price for both countries since the excess auto supply of the United States just matches the excess auto demand in Canada.

The introduction of transportation costs into the analysis modifies the conclusions of the above example. Suppose the per unit cost of transporting an auto from the United States to Canada is P_3P_4, as shown in figure 4.5. The United States would find it advantageous to produce more autos and export them to Canada until its relative price advantage is eliminated. But by including transportation costs in the analysis, the U.S. export price reflects domestic production costs plus the cost of transporting autos to Canada. The basis for trade thus stops when the U.S. auto price plus the transport cost rises to Canada's auto price level. This occurs when the U.S. auto price rises to P_3 and Canada's auto price falls to P_4, the difference between them being the $P_3 - P_4$ per unit transport cost. Instead of a single price ruling in both countries, there will be two domestic auto prices differing by the cost of transportation.

Compared to free trade in the absence of transport costs, under transport costs the high-cost importing country will produce more, consume less, and import less! The low-cost exporting country will produce less, consume more, and export less! Transportation costs therefore tend to reduce the volume of trade, the degree of specialization in production among the nations concerned, and thus the gains from trade.

The inclusion of transportation costs in the analysis modifies our trade

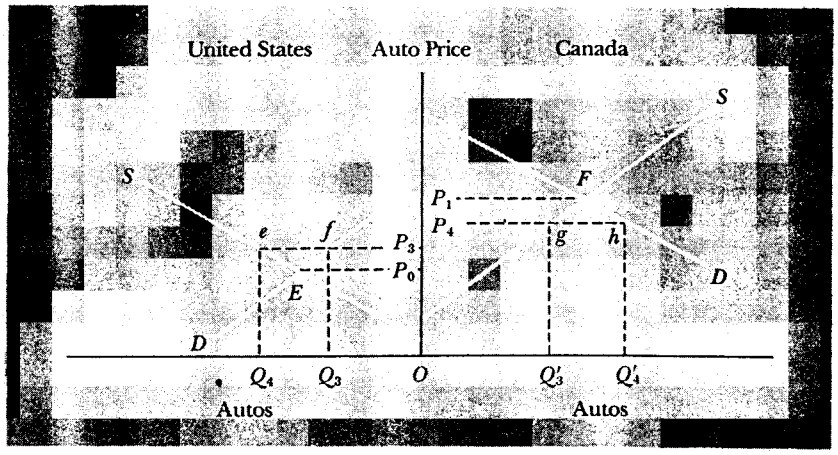

Figure 4.5. Trade Effects of Transportation Costs

model conclusions. A product will be internationally traded as long as the pretrade price differential between the trading partners is greater than the cost of transporting it between them. When trade is in equilibrium, the price of the traded product in the exporting nation is less than that of the importing country by the transportation cost.

Location of Industry

Besides having significant trade effects, transportation costs affect the location of industry. A profit-seeking business firm recognizes the costs of production as well as the costs of transporting raw materials and final products. A firm will achieve its best location when it can minimize its total operating costs, including both production and transportation costs. In terms of location theory, production can be classified into three categories: (1) resource- or supply-oriented; (2) market- or demand-oriented; (3) footloose or neutral.

Resource-oriented industries such as steel and lumber are generally considered *weight losing*. Because the final product is so much less weighty or bulky than the materials from which it is made, the industry will find it advantageous to undergo production near the resource supplies. This is because the cost of transporting finished products is substantially lower than the cost of transporting the inputs used in their manufacture. A firm's transportation costs thus decrease as it locates near the supply of resources. A classic example is the case of the U.S. steel industry, which has tended to undertake steel production closer to the coal supply than to the iron ore supply. This is because, per ton of steel produced, a greater amount of coal than iron ore is used in the production process.

Industrial processes that add weight or bulk to the commodity are likely to be located near the product market in order to minimize transportation costs. An industry tends to be *market-oriented* when its production process is *weight gaining*. This is because the cost of shipping the final product exceeds the cost of transporting the raw materials that go into its production. A firm's transport costs are minimized as it locates close to its product market. A prominent example of weight gaining occurs in the case of Coca-Cola and Pepsi-Cola. These companies transport syrup concentrate to plants all over the world, which add water to the syrup and bottle it. Another example is the U.S. auto industry, which has located assembly plants near regional and even foreign markets. This is because it is cheaper to ship the unassembled auto parts than to ship the finished automobile.

Footloose or *neutral* industries are those that do not find their manufacturing operations pulled close to the resource supplies or the location of market demand. This may occur when: (1) a product is extremely valuable, such as electronic products, so that transportation costs are a very small

portion of the product's total costs; (2) when the product is neither weight gaining nor weight losing. Given these circumstances the industry tends to be quite mobile, locating where the availability and cost of factor inputs permit total production costs to be minimized. Because transportation costs are not of particular significance in a footloose industry, production costs count more as a key determinant of industry location.

SUMMARY

1. The immediate basis for trade stems from relative commodity price differences among nations. Because relative prices are determined by supply and demand conditions, the role of such factors as resource endowments, technology, and national income are important determinants of the basis for trade.

2. The Heckscher-Ohlin theory suggests that differences in relative factor endowments and factor prices constitute the most important explanation of the basis for trade. According to the Heckscher-Ohlin theory, a nation will export the commodity in the production of which a relatively large amount of its relatively abundant and cheap resource is used. Conversely, it will import commodities in the production of which a relatively large amount of its relatively scarce and expensive resource is used. The Heckscher-Ohlin theory also states that with trade the relative differences in resource prices between nations tend to be eliminated.

3. Contrary to the predictions of the Heckscher-Ohlin model, the empirical tests of Wassily Leontief demonstrated that for the United States exports are labor intensive and import-competing goods are capital intensive. This was exactly the opposite of what the Heckscher-Ohlin model predicted. To the extent that factor intensity reversal does occur, then the Leontief paradox is inconclusive.

4. One of the earliest empirical tests of the comparative advantage theory was carried out by G. MacDougall. Contrasting the export patterns of the United States and Great Britain, MacDougall found that wage levels and labor productivity were important determinants of the basis for trade and the direction of trade.

5. According to Staffan Linder, two explanations of world trade patterns exist. Trade in primary products conforms well to the factor endowments theory suggested by Heckscher-Ohlin. But the pattern of trade in manufacturers is best explained by overlapping demands between countries for a commodity. The basis for trade is stronger the more similar the structure of demand for manufactured goods in two countries. Per capita income constitutes the most important determinant of demand structure.

6. One dynamic explanation of international trade patterns is the product life cycle model. This model views a wide variety of manufactured goods as going through a trade cycle, during which a country is initially an exporter, then loses its export markets, and may finally become an importer of the product. Empirical studies have demonstrated that trade cycles do exist for manufactured goods at some times.

7. Transportation costs tend to reduce the volume of international trade by increasing the prices of traded goods. A product will be traded only if the cost of transporting it between nations is less than the pretrade difference between their relative commodity prices. Transportation costs also help govern the location of industry.

STUDY QUESTIONS

1. What are the effects of transportation costs on the location of industry and on the volume of trade?
2. Explain how the international movement of products and of factor inputs promotes an equalization of the factor prices among nations.
3. How does the Heckscher-Ohlin model differ from the Ricardian model in explaining international trade patterns?
4. The Heckscher-Ohlin model points out how trade affects the distribution of income within trading partners. Explain.
5. How does the Leontief Paradox question the overall applicability of the factor endowment model?
6. Why cannot one necessarily judge an industry's competitiveness merely by looking at its unit labor costs relative to those of foreign industries?
7. According to Staffan Linder there are two separate explanations of international trade patterns—for manufacturers and for primary goods. Explain.
8. Do recent world trade statistics support or refute the notion of a product life cycle for manufactured goods?

NOTES

1. Eli Heckscher's explanation of the factor endowment theory was outlined in his article "The Effects of Foreign Trade on the Distribution of Income," *Economisk Tidskrift,* 21 (1919), pp. 497–512. Bertil Ohlin's account is summarized in his *Interregional and International Trade* (Cambridge: Harvard University Press, 1933).